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## A Critical review of Floods History in Kuantan River Basin: Challenges and Potential Solutions

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### ABSTRACT

Kuantan River basin (KRB) is important watershed passing through Kuantan city of state Pahang. Usually, it receives massive precipitation during north east monsoon season start from November to March. Since past years, it is experiencing severe floods with increased frequency by perceiving heavy rainfall, which produces surpass flow rate than river capacity resulting inundation of low-lying or flood plain areas hampered the human social and economic life. KRB has experienced the worst flood events during recent years that caused massive destruction of land use infrastructure, agriculture and irrigation system, loss of lives and properties, which ultimately affect the revenue loss suffered by Government in recovery of survival and loss. The change in climatic condition and anthropogenic activities following change in nature of flood seems occurrence getting more frequent in urbanized areas. The rapid urbanization leads land degradation and deforestation, which result high flow of surface runoff. However, insufficient drainage system and river evolution and its inadequate capacity also irrefutable factors for flood. The determination of this article is to review the ascertaining KRB flooding factors and discuss the existing challenges that are being faced in order to avert the loss from flood catastrophe.

## 1. Introduction

Flood events are often catastrophic leads to damages of physical and social life. From the past decades, increasing flood incidences have been observed due to variations in rainfall patterns, change climate condition. One of the main factors for occurring flood is rapid development in urban sector. Malaysia is vulnerable to flood for being its geographic location in the tropical region. The east coast part of Malaysia's flood often experiences flooding during the northeast monsoon season. Kuantan is one of the flood vulnerable area of peninsular Malaysia. KRB is the important watershed passing through Kuantan. This basin is accountable for bring flood during the wet season by perceiving heavy rainfall fall resulting

the spilling over the flow that inundate flood plain or low-lying areas causing intensified damages in terms of commercial, residential properties, roads, infrastructure, irrigation network. However, in rapid development with in river catchment also be responsible to produce high runoff and worsened river capability. Therefore, leads to increasing flood frequency and magnitude. According to Department of Irrigation and Drainage Malaysia (DID)'s flood reports, 2001/02, 2012/13 were the worst flood. Kuantan is expected to be worst since 1971 due to receive unexpected heavy rainfall, high tide in upstream and downstream.

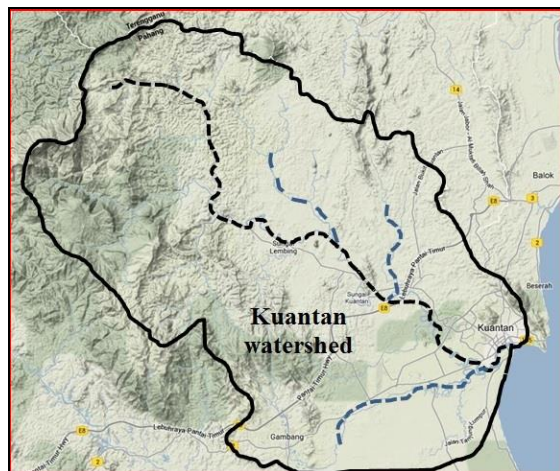
## 2. Background of Study

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Flood is one of the examples of environmental hazard resulted from inequity of the water cycle usually associated with building of urban areas and insufficient drainage design (Schueler, 1994). Approximately 60% of Malaysian Population is residing in flood plain have experienced an unprecedented flood because of its geographic association among river and built-up places. Since, the last decade flood incidences seem to be receiving more frequently from the influence of unpredictable torrential rain, high tide in the catchment. The rapid urbanization causing land use degradation and deforestation also contributed to distress flood hazards. Chan (1997) stated that the risk of flash flooding has increased because of constructing buildings, road, which heads to the impervious surface. Therefore, the society residing in flood plain suffered with tangible and intangible losses carried from flash floods ultimately affect their socio-economic condition. There have been several studies that proved urban development as dominant factor causing rapid river flow, which is a direct consequence of reduced vegetation cover (Lazaro, 1990).

KRB has chosen as study area is an important river of Pahang start from Sg. Lembing passing through Kuantan City and drained in to South China Sea. It covers an area of 1630 km<sup>2</sup>. The elevation range is from 0 at the mouth of watershed to 1511 m in the remotest part of north-west watershed. KBR contains of several main tributaries, which drain the rural, agricultural, urban and industrial areas of Kuantan (Nasir et al.,



**Figure 1:** Kuantan River Basin (KRB)

KRB has history of experiencing the flood since past decades because of its tropical climatic condition torrential rain brings spilling over of river surface runoff inundate low laying areas hampered human

social and economic life. After 30 years of disastrous flood in 1971, the year 2001/02 experienced havoc flood with magnitude of 3.9 brought by continuous heavy rainfall during the northeast monsoon which hit most of the part of Peninsular Malaysia. Pahang was submerged under water after nearby rivers overflowed affected 18,000 people and 22,940 sq.km of land (EKA, 2002). While, right after 10 years another worst flood condition in years 2011/12 paralysed Kuantan. Sudden flood due to continuous massive rainfall affected approximately 6,000 flood victim reportedly; several roads were badly flooded, and hundreds of vehicles trapped in resulting of the poor drainage system that did not cope ponderous rain (Kuala Lumpur Post, 2012). The unpredicted massive flood, recently in 2013 experienced due to prolonged heavy rainfall and land-use change brought serious risk to society. Especially to low laying areas Kuantan and Kemaman. Kuantan was severely distressed. Around 14,044 people evacuated and major damages occurred in terms of electricity, road's structure, buildings and belongings thus government suffered with significant financial cost for repairing flood damages (Jamaludin et al., 2013). Torrential rain caused rise in level of river basin resulting increased outflow discharge.

Which destroyed agricultural crops, caused loss of human lives and property (Rahaman, 2014). According to Abdullah (2002), flood disasters remain to increase in incidence and magnitude, mainly for human to occupy flood plains, ignore the threats of such vulnerable regions, over-develop land and reduce natural resources. Insufficient implementation of flood control regulations is another reason of flood hazards causing significant property damages, loss of economy, inconvenience, and sometimes loss of life are the impacts of flood.

The risk of incidence of flood is remained due to variations in nature of occurrence in a resultant of global warming bring rise in temperature causing heavy rain, rise in sea level, inappropriate river storage and poor drainage produce surplus runoff The most vital recently urbanization taking place rapidly leads to deforestation and land use degradation results fluctuating the nature of flood. Following the disastrous flood events, several studies on river basin carried and constructive steps have been taken for proactive flood control measures by major authorities (Chan, 1997) different structural and non-structural techniques instigating for flood controlling such as early warning, flood forecasting system structured to handle with vulnerability. Similarly, the managing of river basin to avoid overflowing during flash flood and designing upgrade drainage patterns in order to

cesspit the surface runoff generated from urban areas. After the disastrous flood in 1971, Flood Control Commission (FCC) founded by Government took several structural and non-structural steps to cope with serious issue (Chia, 2004). Currently Drainage and Irrigation Department (DID) directing the responsibility for flood control incidences carrying some affective measures with collaboration of other administrations, non- administration agencies, private sectors and societies such as peak flood response, early-warning alert system and restoration of river basins in order to evade the probabilities of catastrophic hazards.



**Figure 2:** Flash Floods at Jalan Tun Ismail, Kuantan  
(source: New Straits Times, 10 December 2011)



**Figure 3:** Flash Flood, Kuantan  
(Source: beforeitsnews, 25 December 2012)



**Figure 4:** Water logging, Arial picture, Kuantan  
(source: The St Timers Only, 06 December 2013)

### 3. Discussion

Malaysia is vulnerable to flood because of geographical location and tropical climatic condition. Global warming brings abnormal torrential rainfall, rise in sea level, which increased flood risk. Malaysia associating with 189 river basins (Mohammad, 2003). Usually, faces two monsoon periods (1) southwest monsoon (SWM); (2) northeast monsoon (NEM). NEM brings heavier rainfall. KRB has chosen as study area, the important river of Pahang state passing Kuantan city and discharge into South China Sea. KRB is one responsible factor of flooding as a result of prolonged heavy rainfall during NEM by producing surplus surface runoff that exceed from basin compensation capacity causing floods to low laying areas and hampered human social and economic life. KRB has experienced the flood in past period's incidences. It has been observed that, change climatic condition resulting abnormal rainfall pattern and perceiving anthropogenic activities following the change in flood nature and incidence getting more frequent with vary in concentration. Recently, the years 2001, 2011 and 2013 has been considered to perceive worst flood disaster after 1971 catastrophic event.

The reason for happening such catastrophe is due to different natural and unnatural evolution processes. Most undeniable is human contribution to global warming causing alteration in temperature brings torrential rain and rapid urban development and transformation following land use changes which disrupt river catchment. Kuantan since the increasing in population growth 2.68% annually (according to Kuantan Municipal Council) experiencing urban and industrial development, which heading to conservation of forest and agricultural land. Another, important factor for occurrence of hazard, KRB has been going to experience changes in land due to increase in population, which is about 70,000. People started to live more urbanize thus it outer the edge of urban limit. Therefore, changes in land use accompanying with deplantation, removal of soil, and degrading land surface fluctuating the rainfall runoff relationship follow-on peak discharge and increased flood frequencies. Constructing the infrastructure and buildings in flood-prone areas is exposed to augmented danger (Konrad, 2014). While, KRB brought the process of sedimentation, soil erosion and siltation characteristic instigating un-uniform breadth and erratic depth shorten river capacity influence from climatic change and anthropogenic activity. There is the need to increase environmental protection strategies.



Presently, the important challenge while processing urban development is to arrange for protective strategy in order to save natural resources from destruction without effecting climate change. According to Rahaman (2014), the strong support to the sustainable land use concept in order to sustain the environment by providing awareness on community based in disaster preparedness and essential preventive measures to respond would help to reduce the human loss probability in severe disaster. However, improved efficient drainage system also effective to cesspit the surface runoff water generated from urban area hence prevent from flooding.

According to Kuantan Municipal Council, the city is predicted to experience more extreme weather conditions in future that with change in rainfall. In Kuantan from administrative authorities conducting study projects to prevent from severe flooding such as suitable early-warning strategy, flood forecasting, and constructing the water reservoirs. However, DID flood warning system is too short (Mohamad et al., 2012) according to the response of local respondents, so they did not have time to prepare themselves for evacuation. There is a need to make efficient warning system using advance hydro metrological technologies give alerts prior to an event occur in a manner that community and decision maker could be able to set security precautions.

#### 4. Conclusion

In sum-up, to prevent KRB and it nearby low laying areas from severe flood events. There is a need to restoration of river to make smooth and capable to cope with surpass water flow, upgrading of efficient drainage system and prevent land use degradation as much possible. The rapid urbanization and land use degradation are most main aspects for causing flash flood. If this continues as so there will be more chances to increased flood intensity, which will be more disastrous and havoc for physical, environmental and economic cost.

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#### References

- Abdullah, K. 2002. Integrated river basin management, in *Buletin Ingenieur*, Penerbit Universiti Sains Malaysia, Penang, Malaysia.
- Chan, N. W. 1997. Increasing flood risk in Malaysia: causes and solutions. *Disaster Prevention and Management*, 6(2), 72-86.
- Chia, C. W. 2004. Managing Flood Problems In Malaysia, in *Buletin Ingenieur*, pp. 38-43, Board of Engineers Malaysia, Malaysia. <http://www.bem.org.my/publication/juneaug04/F%28Flood%29%2838-43%29.pdf>
- Kuala Lumpur Post. 2012. Kuantan – No Christmas for Residents, Poor Drainage System Blamed. *Kuala Lumpur Post: News on Time*. G-Equity Sdn. Bhd., Last accessed 20 Apr. 2014. <http://www.kualalumpurpost.net/kuantan-no-christmas-for-residents-poor-drainage-system-blamed/?id=3>
- Lazaro, T. R. 1990. *Urban Hydrology (revised edition)*, 264 pp., CRC Press, Lancaster, Pennsylvania, USA.
- Mohamad, S., Hashim, N. M., Aiyub, K., and Toriman, M. E. 2012. Flash Flood and Community's Response at Sg. Lembing, Pahang. *Advances in Natural and Applied Sciences*, 6(1), 19-25.
- M. F. Mohammad. 2003. Key Challenges in Urban Flood Mangement, Knowlwdge, Experiecnces and Policy, in Malaysia perspective. in *Regional workshop on climate change and urban flooding management*, UNESCAP.
- Nasir, M. F. M., Zali, M. A., Juahir, H., Hussain, H., Zain, S. M., and Ramli, N. 2012. Application of receptor models on water quality data in source apportionment in Kuantan River Basin. *Iranian journal of environmental health science & engineering*, 9(1), 1-12.
- Jamaludin, M. H., S. Jaafar, B. K. Chuah, and Z. Abdullah. 2013. FLOOD : Kuantan Town Centre Almost Paralysed, 37,100 Evacuated in 4 States." *New Straits Times*. The New Straits Times Press (Malaysia) Berhad, Last accessed 20 Apr. 2014. <http://www2.nst.com.my/latest/font-color-red-flood-font-kuantan-town-centre-almost-paralysed-37-100-evacuated-in-4-states-1.421108>
- Rahaman, H. A. 2014. An Overview of Environmental Disaster in Malaysia and

Preparedness Strategies. *Iranian Journal of Public Health*, 43(3), 17-24.

Schueler, T. 1994. The importance of imperviousness, *Watershed protection techniques*, 1(3): 100-111.

EKA. 2002. 2001 Global Register of Extreme Flood Events. Retrieved 01 May, 2014, <http://www.dartmouth.edu/~floods/Archives/2001sum.htm>

Konrad, C. P. 2014. Effects of Urban Development on Floods." *U.S. Geological Survey, Fact Sheet 076-03*. USGS, Last accessed 20 Apr. 2014. <http://pubs.usgs.gov/fs/fs07603/>